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Propulsion testing

Space shuttle main engine No. 0525 is lifted from the A-2 Test Stand at NASA's John C. Stennis Space Center against the backdrop of the new A-3 Test Stand under construction, offering a glimpse of the past and future in the nation's space exploration program.

Established in the early 1960s, John C. Stennis Space Center has grown into the nation's largest and premier rocket engine test facility. The Stennis Engineering and Test Directorate conducts propulsion test activities on one-of-a-kind national facilities collectively valued at more than $2 billion. State-of-the-art facilities include the A, B and E complexes, where rocket propulsion tests can be conducted on engine components, full-scale engines and even rocket stages.

Stennis was established to flight-certify all first and second stages of the Saturn V "moon rocket" used for the Apollo manned lunar landing program. Today, the center is home to NASA's Rocket Propulsion Test (RPT) Program Office, the principal implementing authority for the agency's rocket propulsion testing. The agency office manages NASA rocket propulsion test facilities located at Stennis Space Center; Marshall Space Flight Center in Huntsville, Ala.; Johnson Space Flight Center-White Sands Test Facility in Las Cruces, N.M.; and Glenn Research Center-Plum Brook Station in Sandusky, Ohio.

The rocket test sites at these NASA centers comprise the primary members of the Rocket Propulsion Test Management Board. The Glenn and Kennedy Space centers are associate members of the board. The RPTM board members cooperate with the Department of Defense propulsion community through the National Rocket Propulsion Test Alliance. This NASA/Department of Defense alliance pursues initiatives that shape the government's rocket propulsion test capability.

Moon rockets, space shuttle and beyond

Stennis conducted the first static test firing of the Apollo Saturn V second-stage prototype engine April 23, 1966. Less than a year later,

testing began on the first and second rocket stages. That led to one of humankind's most amazing achievements, Americans walking on the moon July 20, 1969.

When the Apollo Program ended in December 1972, Stennis test stands were converted from the Apollo/Saturn V configuration to accommodate space shuttle main engines. On May 19, 1975, the first test of a space shuttle main engine took place. On April 12, 1981, the first space shuttle, Columbia, lifted off, powered by engines tested at Stennis.

Every space shuttle main engine used in more than 130 missions has undergone acceptance testing at Stennis. All engines for the remaining shuttle missions – the program is scheduled to end in 2010 – already have been tested at Stennis. Stennis also has completed all "green run" testing for major space shuttle main engine components. "Green run" testing ensures all engine parts have been exposed to flight-like environments prior to use on a shuttle mission. Since 1975, the goal of the rigorous testing schedule at Stennis never has wavered – to make sure space shuttle main engines are as safe, strong and reliable as possible.

However, as the Space Shuttle Program draws to a close, Stennis is preparing to test the next generation of rocket engines being built to carry humans beyond low-Earth.

Work is under way to prepare the A-1 and A-2 test stands for testing on the J-2X engine and components in development. In addition, for the first time since the 1960s, a large test stand is being built at Stennis to provide high-altitude testing. The 300-foot-tall A-3 Test Stand will allow operators to conduct tests at simulated altitudes up to 100,000 feet. The feature is important because if humans are to proceed past low-Earth orbit, they must have rocket engines that will fire in space. The A-3 Test Stand will test to make sure they will.

NASA at Stennis Space Center is heavily involved in testing rockets for the nation's commercial launch sector. The RS-68 engine testing continues in support of the United Launch Alliance Delta IV expendable launch vehicle. Testing for Orbital Science Corporation's Taurus II booster engine, the Aerojet AJ26, began in 2010.

Test stands

The A Test Complex at Stennis Space Center consists of two single-position, vertical-firing test stands designated A-1 and A-2, both built in the 1960s. The stands have been used to conduct full flight-stage and main propulsion systems tests, as well as single-engine tests at sea level and simulated altitudes.

Steam billows from the A-2 Test Stand at Stennis Space Center during a space shuttle main engine test.

The B Test Complex consists of a dual-position, vertical, static-firing test stand designated B-1/B-2, also built in the 1960s. First stages of the Apollo Saturn V rocket were static fired at the test stand from 1967 to 1970. Stennis now leases the B-1 test position to Pratt & Whitney Rocketdyne for testing of the RS-68 engine.

The E Test Complex was constructed in the late 1980s and early 1990s. Today, this versatile, three-stand complex includes seven separate test cells capable of supplying ultra high-pressure gases and cryogenic fluids, using a variety of rocket propellants.

Stennis test stands are linked by a seven-and-one-half-mile canal system used primarily for transporting liquid propellants. Additional features of the test complex include test control centers, data acquisition facilities, a large high-pressure gas facility, an electrical generation plant, and a high-pressure industrial water facility served by a 66-million gallon reservoir.

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